

## CHAPTER 13

### FALL PROTECTION PROGRAM

(Formerly Navy Occupational Safety Health Cost Data)

#### 1301. Purpose

This chapter provides requirements to establish a managed fall protection program to protect Navy civilians and military personnel from the hazards of falling from heights at Navy Shore activities.

#### 1302. Background

a. Falls from heights are a leading cause of work-related injuries and fatalities. The Navy continues to experience serious fall related mishaps, which lead to reduced readiness and productivity, as well as high medical and compensation costs resulting from these mishaps.

b. Mishaps involving falls are generally complex events frequently involving a variety of factors. Consequently, requirements for fall protection involve both work procedures and equipment-related issues in order to protect workers from recognized hazards.

c. The Navy requires activities to protect its personnel from recognized hazards. There is much more to workplace safety than a Navy activity representative arriving at a work site with a copy of the pertinent standards in hand. Navy activities have a duty to anticipate the need to work at heights and to plan their work activities accordingly – this means that effective mishap prevention must be incorporated into the job planning process. Falls are preventable. Careful planning and preparation lay the necessary groundwork for an accident-free workplace.

#### 1303. Policy

Every command, work center, and unit shall have a safety culture with management commitment that promotes a safe work environment for personnel working at heights. The Regional Commander, Commanding Officer/Director, Officer-In-Charge of the Navy Activity is responsible for establishing and implementing a fall protection program, which includes identification and elimination/control of fall hazards. Navy activities are responsible for: assigning responsibilities; surveying and assessing fall hazards; providing prevention and control measures; training of personnel; inspecting the equipment; auditing and evaluation; proper installation and use of fall protection systems; and the availability of rescue equipment with accompanying rescue procedures. Fall protection must be provided to Navy civilians and military personnel exposed to fall hazards on any elevated walking working surface with unprotected sides, edges, or floor openings, from which there is a possibility of falling four feet (five feet for Shipyard Operations) or more to a lower level; or where there is a possibility of a fall from any height onto dangerous equipment, into a hazardous environment, or onto an impalement hazard.

#### 1304. Basic Program Requirements

Each Navy activity, which has personnel exposed to fall hazards, is required to establish a managed fall protection program. The managed fall protection program shall be in writing and approved by the activity's safety office. As an alternative to this requirement, a Navy shore activity, in lieu of a separate written program with safety office review and approval, may state in writing that it is using

the *Department of the Navy-Fall Protection Guide for Ashore Facilities*, reference 13-1, as their fall protection program. A managed fall protection program includes:

- a. Activity Policy
- b. Duties and Responsibilities
- c. Workplace Surveys and Assessment of Fall Hazards
- d. Fall-Hazard Prevention and Control, Including the Preparation of Fall Protection and Prevention Plans (see reference 13-1)
- e. Training
- f. Inspection, Storage, Care, and Maintenance of Fall Protection Equipment
- g. Rescue Procedures
- h. Audits and Evaluation

#### **1305. Activity Policy**

Each activity may prescribe supplementary requirements for special conditions above and beyond the fall protection policy set out in this instruction.

#### **1306. Duties and Responsibilities**

Each Navy activity shall delineate duties and assign responsibilities in the implementation of a managed fall protection program. The activities shall ensure that assigned personnel have the necessary skills, knowledge, training, and expertise to manage, administer, and implement the fall protection program. Depending upon the activity size and mission, personnel who manage, administer and/or implement the fall protection program may either be assigned as full time or as part time (collateral duty) positions.

Personnel assigned to the fall protection program should have the following qualifications and responsibilities:

- a. The Fall Protection Program Manager: A person authorized by the command who is responsible for the development and implementation of the program. The manager shall ensure that personnel exposed to fall hazards and other personnel involved in the program receive adequate training as outlined in appendix A.

#### **NOTE:**

The program manager position need not be an exclusive title designation. With adequate education, training, and experience the same person may also function as a qualified person or competent person.

- b. Competent Person for Fall Protection: A person who is capable of identifying hazardous or dangerous conditions in the personal fall arrest system or any component thereof, as

well as in their application and use with related equipment, AND who has the authority to take prompt corrective measures to eliminate the hazards of falling.

c. Qualified Person for Fall Protection: A person with a recognized engineering degree or professional certificate, and with extensive knowledge, training, and experience in the field of fall protection who is capable of performing design, analysis, and evaluation of fall protection systems and equipment.

d. End User of Fall Protection: A person who has been trained in the use of assigned fall protection equipment, including hands-on training in a typical fall hazard situation, and uses personal fall arrest or fall restraint/positioning device equipment while performing work assignments. A competent person who has the knowledge, expertise, and education to deliver the training should train end users. The competent person should also be qualified as a fall protection trainer for end users.

### **1307. Workplace Surveys and Assessment of Fall Hazards**

a. Each Navy activity shall survey the workplace to identify potential fall hazards in accordance with Chapter 5 of instruction. Navy activities shall determine if the walking or working surfaces on which employees are to work have the strength and structural integrity to safely support the workers. Employees shall not be permitted to work on those surfaces until it has been determined that the surfaces have the requisite strength and structural integrity to support the workers and equipment related to their tasks. Once it has been determined that the surface is safe for employees to work on, then it should be determined if a fall hazard exists at the work location.

b. A fall hazard survey/assessment shall be conducted annually for comparison purposes.

c. After conducting the survey, a fall-hazard analysis shall be performed to determine the risk assessment, hazard severity, and fall mishap probability in accordance with Chapter 12 of this instruction. This will help in prioritizing the hazard ranking and selecting the most viable fall protection solutions.

### **1308. Fall-Hazard Prevention and Control Measures**

a. The hierarchy or preferred order of control measures for fall hazards are:

(1) Elimination - Removing the hazard from a workplace. This is the most effective control measure (e.g., lower various devices or instruments, such as meters or valves to the height level of the individual, instead of servicing such devices or instruments at heights).

(2) Prevention - Isolating or separating the hazard from the general work areas (e.g., same level barriers such as guardrails, walls, or covers.)

(3) Engineering Controls - If the hazard cannot be eliminated, isolated, or separated, engineering control is the next-preferred measure to control the risk (e.g., design change or use of different equipment or techniques such as aerial lift equipment).

(4) Administrative Controls - This includes introducing new work practices that reduce the risk of a person falling (e.g., erecting warning signs or restricting access to certain areas).

(5) Personal Protective Systems and Equipment - These shall be used after other control measures (such as eliminating or isolating a fall hazard) are determined not to be practical, or when a secondary system is needed (e.g., when it is necessary to increase protection by employing a backup system).

**NOTE:**

Control measures are not mutually exclusive. There may be situations when more than one control measure should be used to reduce the risk of a fall.

b. Navy activities shall select fall protection measures compatible with the type of work being performed. If fall hazards cannot be eliminated, fall protection can be provided through the use of:

(1) Guardrail Systems. Guardrails consist of top and mid-rails, posts, and toe boards (toe boards as applicable). Guardrails are used to protect personnel on a walking working surface with unprotected sides or edges from reaching a fall hazard. The specifics on guardrail systems can be found in references 13-1 through 13-4.

(2) Work Platforms. When working from elevated work platforms, four feet (five feet for Shipyard Operations) or higher, the work platforms shall be equipped with a standard guardrail or other fall protection system. The specifics on work platforms can be found in references 13-1, 13-2, and 13-4.

(3) Safety Net Systems. Safety nets shall be installed as close as possible under the walking working surfaces with an unprotected side or edge, or when working over water, or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors, safety lines, full body harnesses, or restraint/positioning belts are impractical. The specifics on safety net systems can be found in references 13-1 and 13-4.

(4) Personal Fall Arrest System. A system used to arrest a person in a fall from a working level. It consists of an anchorage system, connecting means, and full body harness and may include a lanyard, deceleration device, lifeline, or suitable combination of these. The specifics on personal fall arrest systems can be found in references 13-1 through 13-5. A personal fall arrest system must be rigged so that employees will not free-fall more than six feet, nor contact a lower level. See paragraph 1311 below for the requirements for tie-off points (anchorage) used for fall arrest systems. Safety belts (body belts) shall not be used in a personal fall arrest system.

(5) Work Positioning System. A combination of equipment that permits an employee to be supported on an elevated surface, such as a wall, and work with both hands free while leaning backward. The specifics on positioning systems can be found in references 13-1 through 13-4. See paragraph 1311 below for the requirements on tie-off points (anchorage) for a positioning system.

(6) Fall Restraint System. A system consisting of equipment and components connected together designed to restrain a person from reaching an exposed fall hazard. The specifics on restraint system can be found in references 13-1 and 13-3.

(7) Ladder-climbing Safety Devices. A device or climbing sleeve connected to the front D-ring on the climber's full-body harness that slides up or down a rigid rail or cable. Should

a fall occur, the device is designed to lock by inertia or cam-action to arrest the fall. Ladder-climbing safety devices must permit the worker to ascend or descend without continually having to hold, push, or pull any part of the device, leaving both hands free for climbing. These safety devices must be activated within two feet after a fall occurs. Ladder-climbing safety devices shall be attached to a frontal D-ring on the climber's full-body harness.

(8) Covers. Covers for floor holes or floor openings shall be capable of supporting, without failure, at least twice the weight of employee(s), equipment, and materials that may be imposed on the cover at any one time. When covers are removed, a guardrail, attendant, or other system shall be provided to protect floor holes or openings.

**NOTE:**

For fall protection solutions to specific work situations or unique military work applications see reference 13-1.

**1309. Fall Arrest Equipment Selection Criteria**

Navy activities shall only use fall arrest equipment where the manufacturer can substantiate through third party certification that the equipment meets the requirements addressed in reference 13-5, and/or fall arrest equipment is designed, selected, and approved by a Qualified Person for fall protection. Any equipment that has previously met ANSI A10.14 Standards, and is in proper working condition, will be deemed to be usable until January 1, 2007. After January 1, 2007, requirements of reference 13-5 are recommended. See appendix B for the fall arrest equipment selection criteria.

**1310. Training**

a. Training. Navy civilians and military personnel should be trained to recognize fall hazards. Navy civilians and military personnel who use fall protection equipment shall be trained in accordance with appendix A. Other Navy civilians and military personnel involved in the fall protection program should also be trained in accordance with appendix A.

b. Retraining. Retraining in relevant topics shall be provided to the end user when:

(1) The end user has been observed using fall protection equipment in an unsafe manner,

(2) The end user has been involved in a mishap or a near-miss incident,

(3) The end user has received an evaluation that reveals that he or she is not using the fall protection equipment properly,

(4) The end user is assigned a different type of fall protection equipment;  
and/or

(5) A condition in the workplace changes in a manner that could affect the safe use of the fall protection equipment that the end user is to utilize.

c. Refresher training. Personnel exposed to fall hazards shall receive refresher training on the safe use of fall protection equipment at an interval determined by the activity.

### **1311. Anchorage for Fall Arrest Equipment**

a. Fall arrest and restraint/positioning anchorages criteria. See references 13-1 through 13-5.

(1) Fall Arrest Anchorages shall be capable of supporting a minimum force of 5,000 pounds per person attached; or shall be designed, installed, and used under the supervision of a qualified person, and shall maintain a safety factor of at least two. The specifics on anchorages can be found in references 13-1 through 13-5.

(2) Work Positioning Anchorages shall be capable of supporting at least twice the potential impact loading of an employee's fall.

(3) Restraint Anchorages shall have the capacity to withstand at least twice the maximum expected force that is needed to restrain a person from exposure to the fall hazard.

(4) Horizontal Lifeline Anchorages shall be designed, prior to use, by a registered professional engineer with experience in designing horizontal lifeline systems; or designed by a fall protection qualified person who has appropriate training and experience.

b. Fall arrest anchorages in new facilities, buildings and structures. During the design of new facilities, buildings, and structures, fall hazards should be considered and eliminated whenever possible. When elimination of fall hazards is not feasible, the design should include certified and labeled anchorages.

### **1312. Rescue Procedures**

When personal fall arrest systems are used, the Navy activity must ensure that the mishap victim can self-rescue or can be rescued promptly should a fall occur. A rescue plan for an employee suspended in a body harness after a fall shall be prepared in writing by the Navy activity and include a detailed discussion of the following: methods of rescue; methods of self-rescue, equipment used; training requirements, specialized training for the rescuers, procedures for requesting rescue and medical assistance; transportation routes to a medical facility; and pre-incident planning with jurisdictional public and Government-emergency response agencies. Specific guidance on rescue procedures can be found in reference 13-1. A rescue plan for an employee suspended in a body harness after a fall shall be site-specific.

### **1313. Inspection, Storage, Care, and Maintenance of Fall Protection Equipment**

Before each use of fall protection equipment, the user shall carefully inspect the equipment following the inspection steps recommended by the fall protection equipment manufacturer to ensure that it is in good working condition. A fall protection Competent Person, other than the user, must inspect fall protection equipment at least annually. Inspection of the equipment by the fall protection competent person shall be documented. Guidance on storage, care, and maintenance of fall protection equipment can be found in the Navy Fall Protection Guide for Ashore Facilities, reference 13-1, Chapter 7 and in literature furnished by the fall protection equipment manufacturer.

### **1314. Falls from Heights Mishap Reporting**

Falls from heights mishaps under this section shall be reported if they meet the reporting criteria of reference 13-6. When fall arrest equipment is impacted or activated during a fall, it should also be reported as a near-miss using the Hazard Report in reference 13-6.

### **1315. Audits and Evaluations**

Fall protection programs shall be evaluated in accordance with Chapter 2 of this instruction.

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## **Chapter 13**

### **References**

13-1. Department of the Navy Fall Protection Guide for Ashore Facilities

<http://www.safetycenter.navy.mil/osh/downloads/AshoreFallProtectionGuide.pdf>

13-2. 29 CFR PART 1910, Occupational Safety and Health Standards; 1910.21 thru 1910.24; 1910.27 thru 1910.30; 1910.66-Appendices C & D; 1910.67; 1910.68; 1910.176; 1910.178; 1910.179; 1910.180; 1910.268; and 1910.269.

[http://www.osha.gov/pls/oshaweb/owastand.display\\_standard\\_group?p\\_toc\\_level=1&p\\_part\\_number=1910](http://www.osha.gov/pls/oshaweb/owastand.display_standard_group?p_toc_level=1&p_part_number=1910).

13-3. 29 CFR PART 1915, Occupational Safety and Health Standards for Shipyard Employment; 1915.5; 1915.71 thru 1915.77; 1915.151 thru 1915.152; 1915.159 thru 1915.160.

[http://www.osha.gov/pls/oshaweb/owastand.display\\_standard\\_group?p\\_toc\\_level=1&p\\_part\\_number=1915](http://www.osha.gov/pls/oshaweb/owastand.display_standard_group?p_toc_level=1&p_part_number=1915).

13-4. 29 CFR PART 1926.500, Subpart M, Fall Protection Requirements in the Construction Industry

[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=10922](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10922).

13-5. American National Standard Institute (ANSI) Z359.1 (latest revision), Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components (NOTAL)

<http://www.ansi.org/>.

13-6. OPNAVINST 5102.1D/MCO P5102, of 7 Jan 05, "Navy and Marine Corps Mishap and Safety Investigation, Reporting, and Record Keeping,

<http://www.safetycenter.navy.mil/instructions/ashore/5102/default.htm>

## Appendix 13-A

### Fall Protection Training Requirements and Methods

Trainee GROUP	Desired Training Objectives	Training Mechanism and Type
End User/Authorized Person	<ul style="list-style-type: none"> <li>- Selection and safe use of equipment</li> <li>- Application limits</li> <li>- Proper anchoring and tie-off techniques</li> <li>- Estimation of fall distances</li> <li>- Determination of deceleration distance</li> <li>- Total fall distance</li> <li>- Methods of inspection</li> <li>- Storage, care, and maintenance of equipment</li> <li>- Applicable regulations</li> <li>- Limitations of equipment</li> <li>- Specific lifelines</li> <li>- Rescue and self rescue techniques</li> <li>- Recognize fall-hazard deficiencies</li> <li>- Recognize fall risks at worksite</li> </ul>	<p>Formal/hands-on training using local equipment or on-site training as applicable to the activity</p> <p>(16 hours or as appropriate)</p>
Safety Professional/ROICC Personnel	<ul style="list-style-type: none"> <li>- Recognize fall-hazard deficiencies</li> <li>- Recognize fall risks at worksite</li> <li>- Basic fall protection systems inspection</li> <li>- Methods of use</li> <li>- Proper anchoring and tie-off techniques</li> <li>- Methods of inspection and record keeping</li> <li>- Storage of the equipment</li> <li>- Applicable regulations</li> </ul>	Interactive CD-ROM or Formal Classroom
COTR/COR/CA Personnel	<ul style="list-style-type: none"> <li>- Recognize fall-hazard deficiencies</li> <li>- Recognize fall risks at a worksite</li> <li>- Basic systems identification and proper use of equipment.</li> </ul>	<p>Formal Classroom</p> <p>(Awareness Training)</p>
Competent Person (As Designated by the Activity or Designated in Writing as the Competent Person)	<ul style="list-style-type: none"> <li>- In addition to the authorized person training, the competent person training shall also include:</li> <li>- Various fall protection systems</li> <li>- Donning of the equipment</li> <li>- Proper inspection and record keeping</li> <li>- Recognize and identify fall hazards at work-site</li> <li>- Equipment installation techniques</li> <li>- Proper anchoring and tie off techniques</li> <li>- Risk assessment and hazard ranking</li> <li>- Review and approval of fall protection and prevention plans, and rescue and</li> </ul>	<p>Competent Fall Protection Person and Program Manager CIN A493-0084</p> <p>(Minimum 32 hours)</p>



	evacuation plans - Applicable fall protection regulations - Plan and specification review and approval	
Qualified Person	- Design, select, analyze, and certify fall protection systems and equipment - Preparation, update, review, and approval of fall protection and prevention plans, and rescue and evacuation plans - Fall protection regulations and standards - Plan and specification review and approval	Formal Classroom (40 hours or as appropriate)
Architects and Engineers	- Understand various fall protection and prevention planning and design considerations during construction and maintenance phases - Recognize fall-hazard deficiencies - Recognize fall risks assessment and control measures at worksites - Basic systems identification and proper use	Formal Classroom Interactive CD-ROM (Awareness Training)
Fall Protection Program Managers/ Administrators	- Recognize and identify fall hazards at workplaces - Risk assessment and hazard ranking - Selection, safe use, and limitation of fall protection systems and equipment - Storage, care, and maintenance of the equipment - Applicable fall protection regulations	Course Number CIN A-493-0084 (Minimum 32 hours) Fall Protection Competent Person and Program Manager (CIN A-493-0084)
Supervisors of End Users	- Fall protection awareness training - Familiarization with SOPs - Local program requirements - Proper inspection and record keeping - Proper anchoring and tie-off techniques	Local Training plan/briefing, and/or instruction or SOP (Awareness Training)

## **Appendix 13- B** **Personal Fall Arrest Equipment Criteria**

### **1. Personal Fall Arrest Equipment**

Elements of a Personal Fall Arrest System (PFAS) consist of an anchorage, connectors, and a full body harness and may include a deceleration device, lifeline, or suitable combinations. The PFAS must be capable of arresting a free fall safely, suspend the victim vertically while awaiting rescue, and allow rescue personnel to accomplish identified tasks in a fall hazard situation. All components and subcomponents of a PFAS must be compatible.

### **2. Components of a PFAS are as follows:**

a. **Harness (Full Body)** A full body harness is the fundamental component of every PFAS. A wide variety of body harnesses are available that meet the requirements of ANSI Z359.1. There are two basic types of full body harnesses. The Type I harness is the H style harness with a chest strap that horizontally connects two vertical shoulder straps. The Type II harness consists of shoulder straps that cross at the chest. Full body harnesses used in fall arrest may also be integrally designed into coveralls or vests. Fundamentally, full body harnesses meeting the requirements of ANSI Z359.1 have the following common characteristics:

- (1) A dorsal "D" ring located along the centerline of the back approximately at the lower shoulder blade height.
- (2) Manufactured using synthetic straps or webbing.
- (3) Leg straps, shoulder straps, and buttocks strapping, which is fastened about the person and is used in a variety of combinations to distribute the fall arrest forces to over at least the upper thighs, pelvis, chest, and shoulders to reduce the potential of injury from impact forces.
- (4) After arresting a fall, suspends the victim approximately vertically.

In addition to these common characteristics, the design of a full body harness may incorporate the following additional features:

- (1) A frontal "D" ring for use with ladder climbing systems (notched rail or vertical wire rope systems).
- (2) Side "D" rings located at the side near the hip region, permitting the harness to be used in a work positioning system, which allows personnel to work with their hands free (Note: The side "D" rings are not to be used to arrest a fall).
- (3) Shoulder "D" rings that can be used to lower or recover personnel from confined spaces. These "D" rings are located at the top of each shoulder strap and are usually smaller in size than the dorsal "D" ring.

(4) Waist belts, depending upon the design, may be integral to the full body harness and necessary for proper use; or simply a convenience for attaching tools, carrying pouches, or providing lower back support.

(5) Shoulder pads, leg padding, integral elastic webbing, and a wide variety of other features that add commercial viability to products.

Full body harnesses designed as part of a PFAS may be used in a fall restraint system. A fall restraint system is used to keep personnel from a location that exposes them to the hazards of a fall.

Consideration must be given to the following items when selecting the appropriate full body harness:

- (1) Expected duration that personnel will be wearing the body harness.
- (2) Body stature and size of personnel assigned (one size does not fit all).
- (3) Gender of personnel expected to wear the harness.
- (4) Additional features that are task specific. These features must be carefully selected. For example, if a harness is used with a ladder-climbing device, a frontal "D" ring must be provided.

b. **Lanyards.** The lanyard as part of a PFAS connects the full body harness to an anchorage and reduces the forces of a fall through an integral shock absorber (deceleration device). Lanyards are available in three-, four-, or six-foot lengths, although longer safety lanyards are available. Lanyards must have self-locking snap hooks or carabineers and be designed for a PFAS. Commercial variations include adjustable lanyards that allow the lanyard to be shortened, reducing potential free fall distance. Variations also include lanyards with built-in chaffing protection and may include a "D" ring connector that allows a lanyard to be used to wrap around an anchorage. Double "Y" lanyards allow for 100% tie-off (i.e., one lanyard can always be connected to an anchorage).

When selecting a lanyard consideration must be given to the availability and location of the anchorage point, free fall and total fall distance, potential chaffing and weight and bulk of the person, and equipment.

c. **Tie-off Adapters.** The tie-off adapter is a common component of a PFAS. The tie-off adapter is, in essence, two "D" rings connected together by synthetic webbing or wire rope, typically with built-in chaffing protection. The tie-off adapter allows personnel to improvise an anchorage by wrapping the adapter around a structural member of suitable strength. A lanyard or other components of the PFAS can then be attached to the tie-off adapter. Tie-off adapters can be found in three-, four-, and six-foot lengths. Additional lengths can be purchased.

When selecting a tie-off adapter as part of a PFAS, consideration must be given to potential misuse and inappropriate use. Anchorages have failed when the tie-off adapters were not attached to sufficiently strong structural members.

d. **Self-Retracting Lanyard.** The self-retracting lanyard (SRL), also known as a self-retracting lifeline, refers to a wide variety of commercially available devices. An SRL is a device containing a drum-wound line or strap. This line can be slowly extracted from, or retracted onto the drum under slight tension during normal employee movement. After onset of a fall, the line automatically locks the drum and arrests the fall. The SRL is typically used in a vertical mode and is attached to a suitable overhead structural member. A locking snap hook at the end of the webbing or wire rope is attached to the dorsal "D" ring. The mechanism works in a manner similar to a retractable automobile seatbelt. The SRL comes in lengths from a few feet to an excess of a hundred feet in length. SRL advantages include a self-tending lifeline and reduced free fall distance. Disadvantages include high cost, weight of the equipment, requirement for specialized inspections, and the possibility of swinging into an obstruction during a fall if the SRL is extended too far horizontally.

e. **Vertical Lifeline/Rope Grab.** A vertical lifeline is a vertical line or rope attached from a fixed overhead anchorage independent of the walking/working surface to which a lanyard or ladder climbing device is attached. Only one person shall be attached to a vertical lifeline. Two workers will require two independent vertical lifelines.

A rope grab is a device that travels on a rope or cable and automatically engages the line and locks to arrest the fall of a worker. The rope grab is a very useful component of a PFAS when vertical mobility is required. When the rope grab is designed to manually lock, it may be used in a horizontal mode as part of a fall restraint system.

f. **Anchorage Connectors.** A wide variety of anchorage connectors are available as part of a PFAS. Examples of anchorage connectors include carabiners, beam clamps, roof anchors, and self-locking eye connectors. Anchorage connectors shall be designed in accordance with reference 13-5 to assure compatibility with other components of a PFAS.

g. **Horizontal Lifeline.** A horizontal lifeline is any flexible line commonly made of wire, wire rope, strapping, or rope strung horizontally between two anchorages. A horizontal lifeline can be a part of a PFAS. A horizontal lifeline can be either a permanent or a temporary system. A horizontal lifeline shall be designed, installed, and used under the supervision of a qualified person as part of a complete fall arrest system that maintains a safety factor of two.

Horizontal lifelines are available in kit forms and in a variety of lengths and styles. A properly designed kit contains specialized components to maintain proper tension of the lifeline, and to prevent the attachment points of the lifeline from exceeding designed strength requirements.